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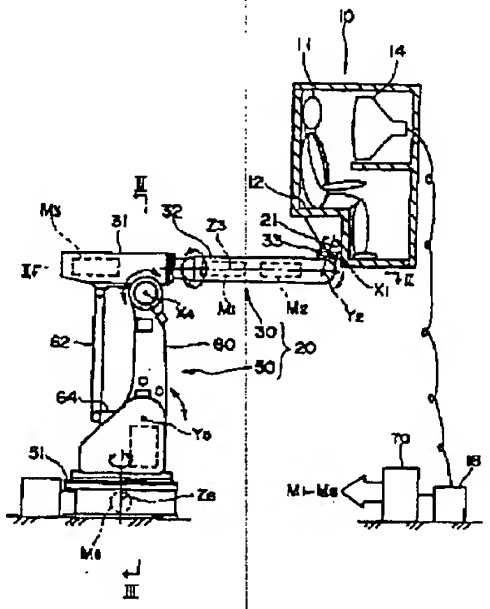
(54) SIMULATOR

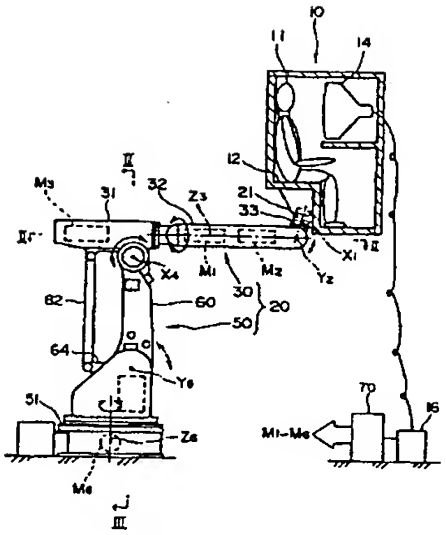
(57) Abstract:

PURPOSE: To provide the simulator which is superior in mobility by carrying a simulation box with the arm of a vertical articulation six-axial robot.

CONSTITUTION: This simulator consists of the simulation box 10 on which a person can be mounted and the vertical articulated robot 20. In the box 10, a seat for the person and a display 14 where a simulation image is projected are installed. The robot consists of an arm part 50 which can rotate a box carrying part 21 where the box 10 is coupled around three orthogonal axes X_1, Y_2, and Z_3 and an arm part 50 which can rotate the arm part 30 around axes X_4, Y_5, and Z_6. The rotating operations of this robot around the six axes are combined to put the box 10 in three-dimensional rotating operation and this simulator is usable for a roller coaster, etc.



【図1】



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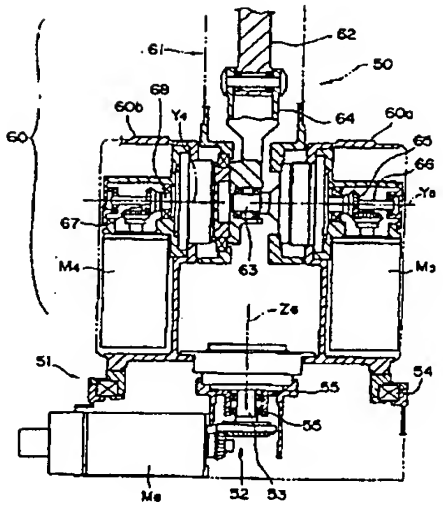

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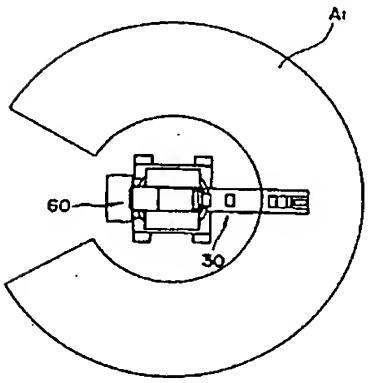

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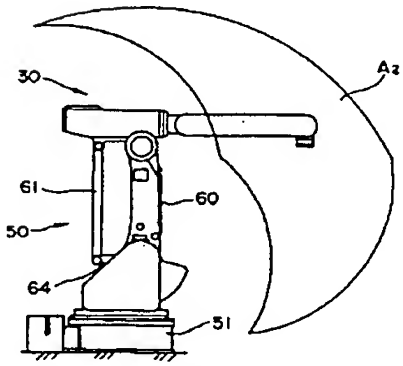

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【特許請求の範囲】

【請求項1】　シミュレーション画像表示用のディスプレイの設置されたシミュレーションボックスが垂直多関節六軸ロボットのアームに担持されたことを特徴とするシミュレータ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明はシミュレーションボックス内の人がディスプレイの画面を見ながら擬似体験できるシミュレータに関する。

【0002】

【従来の技術】この種の従来技術としては、例えば図6に示されるように、シミュレーションボックス1がフレーム2に対しX軸回りに回転し、フレーム2がフレーム3に対しY軸回りに回転し、フレーム3がフレーム4に対しZ軸回りに回転する構造となっている。さらにシミュレーションボックス1に直線運動させるには、フレーム4をレールに沿って走行させる等の装置全体を走行させる走行機構が設けられていた。

【0003】

【発明の解決しようとする課題】前記した従来のシミュレータでは、どうしても装置が大型化してスペースをとられる。また大型な上に駆動エネルギーもかさむため、高価なものとなるという問題があった。本発明は前記従来技術の問題点に鑑みなされたもので、その目的はコンパクトにして安価なシミュレータを提供することにある。

【0004】

【課題を解決するための手段】複数のプレスが連続して設けられたプレスラインの隣接プレス間には、部品を搬送するロボットとして多関節ロボットが用いられているが、発明者は、この多関節ロボットをシミュレーションボックスを駆動する駆動部として応用できるのではないかという発想から本発明をなすに至ったものである。

【0005】前記目的を達成するために、本発明に係るシミュレータにおいては、シミュレーション画像表示用のディスプレイを設置したシミュレーションボックスを垂直多関節六軸ロボットのアームで担持するようにしたものである。

【0006】

【作用】垂直多関節六軸ロボットは、コンパクトにしてロボットのアーム部が人間の手首と同様の動きができるとともに、機動性に優れシミュレーションボックスを如何様にも動かすことができる。

【0007】

【実施例】次に、本発明の実施例を図面に基づいて説明する。図は本発明の一実施例を示すもので、図1はシミュレータの正面図、図2はシミュレータの要部である垂直多関節ロボットのアーム部の内部構造を示す水平断面図（図1に示す線II－IIに沿う断面図）、図3は同ロボットの脚部の内部構造を示す断面図（図1に示す線III－IIIに沿う断面図）、図4及び図5はシミュレーションボックスの移動エリアを示す図である。

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【0008】これらの図において、シミュレータは、人の搭載できるシミュレーションボックス10（以下単にボックスという）と、このボックス10を担持する垂直多関節六軸ロボット（以下単にロボットという）20とから構成されている。ボックス10内には、人11が座るための椅子12が設けられ、椅子12の前方にはシミュレーション画像を映し出すディスプレイ14が設置されている。ディスプレイ14には、シミュレーション映像、例えばジェットコースタの搭乗者から見える映像が映し出される。

【0009】ロボット20は、ボックス10の連結されるボックス担持部21を直交三軸X_1，Y_2，Z_3軸回りに回動動作できるアーム部30と、アーム部30をX_4，Y_5，Z_6軸回りに回動動作できる脚部50とから構成されている。アーム部30は、脚部50に支承されたアーム基部31と、アーム基部31の前方に同軸状に延出するアーム本体32と、アーム本体32の先端に設けられた先端揺動部33とからなる。そしてアーム先端揺動部33はアーム本体32に対しY_2軸回りに回動可能に支承されており、アーム本体32内に設置されたモータM_2の回転駆動力が傘歯車機構34からアーム本体の一側面に設けられたプーリ35とベルト36を介して先端揺動部33に伝達され、これによって先端揺動部33がY_2軸回りに回動する。

【0010】また先端揺動部33には、ボックス担持部21がX_1軸回りに回動可能に支承されている。そしてアーム本体32内のモータM_2の前方位置に設置されたモータM_1の回転が、傘歯車機構34aからアーム本体の他側面に設けられたプーリ37とベルト38を介して従動軸38に伝達される。さらに従動軸38に設けた傘歯車機構39を介してボックス担持部21側の支軸21aに伝達され、これによってボックス担持部21がX_1軸回りに回動する。

【0011】またアーム本体32は、アーム基部31に対し回転可能に支承されるとともに、アーム本体32の基端部側の従動軸40bがアーム基部31内に設けたモータM_3の出力軸40aに減速機41を介して連結され、モータM_3の回転駆動によってアーム本体32がZ_3軸回りに回転する。なお符号42～47はベアリング機構である。

【0012】脚部50は、脚本体60が床面に設置された架台51上にZ_6軸回り回動可能に支承された構造で、架台51内に収容されたモータM_6の回転駆動が傘歯車機構52を介して脚本体60に一体化されている従動軸53を回動し、これによって脚本体60がZ_6軸回りに回動、即ち水平回動する。なお符号54，55はベアリング機構である。

English Translation of Japanese
Patent Laying-Open No. 5-158399

[Title of the Invention]

Simulator

[Claim for Patent]

1. A simulator, comprising a simulation box having a display for displaying a simulation image, carried by an arm of a vertical articulation 6-axial robot.

[Detailed Description of the Invention]

[0001]

[Industrial Field of Application]

The present invention relates to a simulator that allows a person in the simulation box to have virtual experience while viewing images on the display.

[0002]

[Prior Art]

A prior art example of this type has such a structure as shown in Fig. 6 in which a simulation box 1 rotates about an X axis relative to a frame 2, the frame 2 rotates about the Y axis relative to a frame 3, and the frame 3 rotates about the Z axis relative to a frame 4. In order to realize linear motion of simulation box 1, a traveling mechanism has been provided, which allows traveling of the apparatus as a whole, for example, in which the frame 4 travels along a rail.

[0003]

[Problems to be Solved by the Invention]

The conventional simulator described above unavoidably has a large size and occupies a large space. In addition to the large size, it also requires much driving energy, resulting in high cost. The present invention was made in view of the problems of the prior art, and its object is to provide a compact and inexpensive simulator.

[0004]

[Means to Solve the Problems]

Along a press line on which a plurality of presses are provided continuously, an articulation robot is used as a robot for conveying parts, between adjacent presses. Based on an idea that the articulation robot may be applicable as a driving unit driving a simulation box, the inventor achieved the present invention.

[0005]

The above described object can be attained by the simulator in accordance with the present invention in which a simulation box having a display for displaying simulation images is carried by an arm of a vertical articulation 6-axial robot.

[0006]

[Function]

The vertical articulation 6-axial robot is compact and the arm portion of the robot is capable of operations similar to those of a human wrist. Further, the robot has superior maneuverability and it can move the simulation box in any arbitrary manner.

[0007]

[Embodiment]

An embodiment of the present invention will be described with reference to the figures. The figures represent an embodiment of the present invention, in which Fig. 1 is a front view of the simulator, Fig. 2 is a horizontal cross section (taken along the line II-II of Fig. 1) representing internal structure of the arm portion of the vertical articulation 6-axial robot as the main portion of the simulator, Fig. 3 is a cross section (taken along the line III-III of Fig. 1) representing an internal structure of the leg portion of the robot, and Figs. 4 and 5 represent areas of movement of the simulation box.

[0008]

In these figures, the simulator includes a simulation box 10 (hereinafter simply referred to as a box) that is occupied by a person, and a vertical articulation 6-axial robot (hereinafter simply referred to as a robot) 20 carrying the box 10. In the box 10, there is a seat 12 to be occupied by a person 11, and in front of the seat 12, a display 14 is provided, on which

simulation images are displayed. On the display 14, simulation images, for example images viewed by a rider of a roller coaster, are displayed.

[0009]

The robot 20 includes an arm portion 30 that can rotate a box carrying portion 21, to which the box 10 is connected, around three orthogonally crossing axes X_1, Y_2 and Z_3, and a leg portion 50 that can rotate the arm portion 30 about the X_4, Y_5 and Z_6 axes. The arm portion 30 consists of an arm base 31 supported by the leg portion 50, an arm body 32 extending coaxially in front of the arm base 31, and a tip swingable portion 33 provided at the tip end of arm body 32. The arm tip swingable portion 33 is supported rotatable about Y_2 axis relative to arm body 32. A rotary driving force of a motor M_2 provided in arm body 32 is transmitted through a bevel gear mechanism 34 and a pulley 35 and a belt 36 provided on one side of arm body to the tip swingable portion 33, so that the tip swingable portion 33 rotates about the Y_2 axis.

[0010]

At the tip swingable portion 33, the box-carrying portion 21 is supported rotatably about the X_1 axis. Rotation of a motor M_1 provided in front of motor M_2 in arm body 32 is transmitted from bevel gear mechanism 34a through a pulley 37 and a belt 38 provided on the other side of the arm body, to a driven shaft 38. The force is further transmitted through a bevel gear mechanism 39 provided on the driven shaft 38 to a support shaft 21a on the side of the box carrying portion 21, so that the box carrying portion 21 rotates about the X_1 axis.

[0011]

The arm body 32 is supported rotatable about the arm base portion 31, and a driven shaft 40b on the proximal end side of arm body 32 is coupled to an output shaft 40a of a motor M_3 provided in the arm base portion 31 with a reduction gear 41 interposed. Thus, by the rotary drive of motor M_3, arm body 32 rotates about the Z_3 axis. Here, reference characters 42 to 47 represent bearing mechanisms.

[0012]

Leg portion 50 has such a structure that is supported rotatable about

the Z_6 axis, on a pedestal provided on the floor. Rotary drive of a motor M_6 contained in pedestal 51 rotates a driven shaft 53 integrated with the leg body 60 by means of a bevel gear mechanism 52, so that the leg body 60 rotates about the Z_6 axis, that is, rotate in the horizontal direction. Here, reference characters 54 and 55 represent bearing mechanisms.

[0013]

The leg body 60 mainly includes a hollow column 61 supporting the arm base portion 31, a vertical link 62 coupled by means of a pin to a rear end of the arm base portion 31 and extending parallel to the column 61, and a horizontal lever 64 supported by a horizontal shaft 63 provided at a lower end of the leg body 60 and coupled to a lower end of vertical link 62. A motor M5 provided at a lower portion 60a of leg body 60 is adapted to rotate a horizontal support shaft 63 and a horizontal driven shaft 66 fixed and integrated with a lower end of column 61 by means of a bevel gear mechanism 65, so that column 61 rotates about the Y_5 axis.

[0014]

At a lower portion 60b of leg body 60 opposing to the position of motor M_5, a motor M_4 is provided, which motor M_4 rotates a second horizontal driven shaft 68 by means of a bevel gear mechanism 67. A proximal end of horizontal lever 64 is coaxially supported by horizontal support shaft 63, and fixed and integrated with the second horizontal driven shaft 68. Therefore, when horizontal lever 64 swings about the Y_4 axis (Y_5 axis), arm portion 30 rotates about the X_4 axis.

[0015]

Fig. 6 represents a movable area A_2 of box 10 in the horizontal direction, and Fig. 7 represents a movable area A_2 of box 10 in the vertical direction. By rotating robot 20 about six axes X_1, Y_2, Z_3, X_4, Y_5 and Z_6, that is, by combining rotations about six axes, box 10 can move in any arbitrary manner, within the areas A_1 and A_2.

[0016]

Reference numeral 70 represents a microcomputer provided near the robot 20, for controlling drive of motors M_1 to M_6 in the robot. The display 14 in the box 10 is connected through a video player 16 to microcomputer 70.

In accordance with video signals output from video player 16 to display 14, microcomputer 70 outputs driving signals to motors M_1 to M_6, controlling the box 10 such that the attitude of the box correspond to the images displayed on display 14. Therefore, it is possible for the person in the box 10 (occupant 11) to have a virtual experience as if he/she is riding on a roller coaster.

[0017]

Though a simulator of a roller coaster has been described in the embodiment above, it is needless to say that the present invention is also applicable as simulators of various other applications.

[0018]

[Effects of the Invention]

As is apparent from the description above, in the simulator of the present invention, the simulation box is carried by a vertical articulation 6-axial robot of which arm portion is capable of operations similar to those of a human wrist. Therefore, a light weight, versatile and inexpensive simulator that requires small space for installation and small driving energy (power consumption) is obtained.

[Brief Description of the Drawings]

Fig. 1 is a front view of a simulator representing an embodiment of the present invention.

Fig. 2 shows an internal structure of an arm portion of the articulation robot as a main portion of the simulator.

Fig. 3 shows an internal structure of the leg portion of the articulation robot.

Fig. 4 shows a movable area of the simulation box in horizontal direction.

Fig. 5 shows a movable area of the simulation box in the vertical direction.

Fig. 6 is a schematic diagram of a conventional simulator.

[Description of the Reference Characters]

10 simulation box

11 occupant

14 display
20 vertical articulation 6-axial robot
21 simulation box carrying portion
30 arm portion
50 leg portion
X_1, Y_2, Z_3, X_4, Y_5, Z_6 rotation support shafts